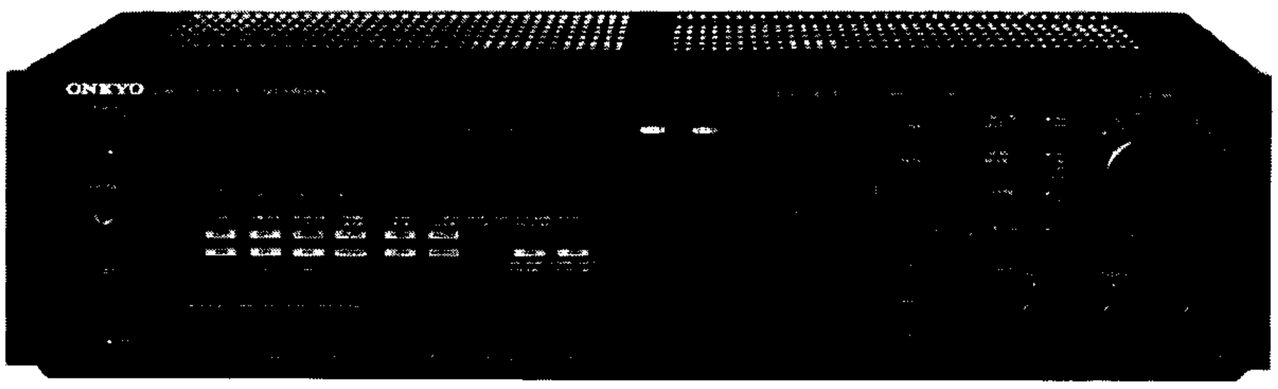
TX-38

SERIAL NO. 3223

ONKYO SERVICE MANUAL

QUARTZ SYNTHESIZED TUNER AMPLIFIER MODEL TX-38



Black model

BUD, BUDN	120V AC, 60Hz
BUG	220V AC, 50Hz
BUQA	240V AC, 50Hz

SAFETY-RELATED COMPONENT WARNING!!
COMPONENTS IDENTIFIED BY MARK ⚠ ON THE SCHEMATIC DIAGRAM AND IN THE PARTS LIST ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE THESE COMPO NENTS WITH ONKYO PARTS WHOSE PART NUMBERS APPEAR AS SHOWN IN THIS MANUAL.

MAKE LEAKAGE-CURRENT OR RESISTANCE MEASUREMENTS TO DETERMINE THAT EXPOSED PARTS ARE ACCEPTABLY INSULATED FROM THE SUPPLY CIRCUIT BEFORE RETURNING THE APPLIANCE TO THE CUSTOMER.

ONKYO
AUDIO COMPONENTS

SPECIFICATIONS

AMPLIFIER SECTION

Power output:	55 watts per channel, min RMS, at 8 ohms, both channels driven, from 20Hz to 20kHz, with no more than 0.04% THD.	
Musical Power Output:	2 ×122 watts at 4 ohms, 1kHz (DIN) 2 ×79 watts at 8 ohms, 1kHz (DIN)	
Continuous Power Output:	2 ×79 watts at 4 ohms, 1kHz (DIN) 2 ×55 watts at 8 ohms, 1kHz (DIN)	
Total Harmonic Distortion:	0.04% at rated power 0.04% at 1 watt output	
IM Distortion:	0.04% at rated power 0.04% at 1 watt output	
Damping Factor:	35 at 8 ohms	
Frequency Response:	20-30,000Hz ± 1dB	
RIAA Deviation:	20-20,000Hz ±0.8dB	
Sensitivity and Impedance:	Phono: 2.5mV/50kohms CD/Tape Play: 150mV/50kohms Tape Rec: 150mV/3.5kohms (Phono)	
Phono overload:	150mV RMS at 1kHz, 0.04% THD	
Signal-to-Noise Ratio:	Phono: 85dB (at 10mV input, A weighted) 75dB (IHF A-202) CD/Tape: 95dB (A weighted) 80dB (IHF A-202)	
Tone Controls:	Bass: ± 10dB at 100Hz Treble ± 10dB at 10kHz	
Loudness (-30dB):	+7dB at 70Hz, +5dB at 10kHz	
Subsonic Filter:	-6dB at 15Hz	

TUNER SECTION	**-220V model-**	**-120V model-**
FM:		
Tuning Range:	87.50-108.00MHz (50kHz steps)	87.5-108.0MHz (100kHz steps)
Usable Sensitivity:	Mono: 11.2dBf, 1.0μV, 75 ohms 0.9 μV (S/N 26dB, 40kHz Devi.) 75 ohms DIN Stereo: 18.0dBf, 2.2μV, 75 ohms 23μV (S/N 46dB, 40kHz Devi.) 75 ohms DIN	Mono: 10.8dBf, 1.9μV Stereo: 17.2dBf, 4.0μV
50dB Quieting Sensitivity:	Mono: 18.0dBf, 2.2μV, 75 ohms Stereo: 37.2dBf, 20 μV, 75 ohms	Mono: 17.2dBf, 4.0μV Stereo: 37.2dBf, 40 μV
Capture Ratio:	1.5dB	1.5dB
Image Rejection Ratio:	85dB	40dB
IF Rejection Ratio:	90dB	90dB
Signal-to-Noise Ratio:	Mono: 72dB Stereo: 67dB	Mono: 72dB Stereo: 67dB
Selectivity:	50dB DIN (±300kHz, 40kHz Devi.)	———
ACA:	———	55dB
AM Suppression Ratio:	50dB	50dB
Harmonic Distortion:	Mono: 0.15% Stereo: 0.25%	Mono: 0.15% Stereo: 0.25%
Frequency Response:	30-15,000Hz ±1.5dB	30-15,000Hz ±1.5dB
Stereo Separation:	45dB at 1kHz 30dB at 100-10,000Hz	45dB at 1kHz 30dB at 100-10,000Hz
Tuning Level (Hi/Lo):	23.2dBf, 4μV/17.2dBf, 2μV	23.2dBf, 8μV/17.2dBf, 4μV
Stereo Threshold (Hi/Lo):	23.2dBf, 4μV/17.2dBf, 2μV	23.2dBf, 8μV/17.2dBf, 4μV
AM:		
Tuning Range:	522-1,611kHz (9kHz steps)	520-1,710kHz (10kHz steps)
Usable Sensitivity:	30μV	30μV
Image Rejection Ratio:	40dB	40dB
IF Rejection Ratio:	40dB	40dB
Signal-to-Noise Ratio:	40dB	40dB
Harmonic Distortion:	0.7%	0.7%
GENERAL		
Dimensions (W×H ×D):	435 ×112 ×343mm 17-1/8" ×4-7/16" ×13-1/2"	435 ×112 ×343mm 17-1/8" ×4-7/16" ×13-1/2"
Weight:	8.5kg., 18.8lbs.	8.5kg., 18.8lbs.

Specifications and features are subject to change without notice.

SERVICE PROCEDURES

1. Replacing the fuses

For continued protection against fire hazard, replace only with same type and same rating fuse.

D (120V) model

Circuit no.	Part no.	Description
F501, F601	252059	4A (SS-2), Speaker protection
F901	252049	4A (ST-6), Primary

G (220V) model

Circuit no.	Part no.	Description
F501, F601	252077	4A-SE-EAK, Speaker protection
F902	252074	2A-SE-EAK, Primary
F903, F904	252078	5A-SE-EAK, Secondary
F905	252078	1A-SE-EAK, Secondary

2. Replacing the lamp

This unit uses the lamp listed below.

Circuit no.	Part no.	Description
PL901	210064A	PL6.3V, 250mA, Dial plate illumination

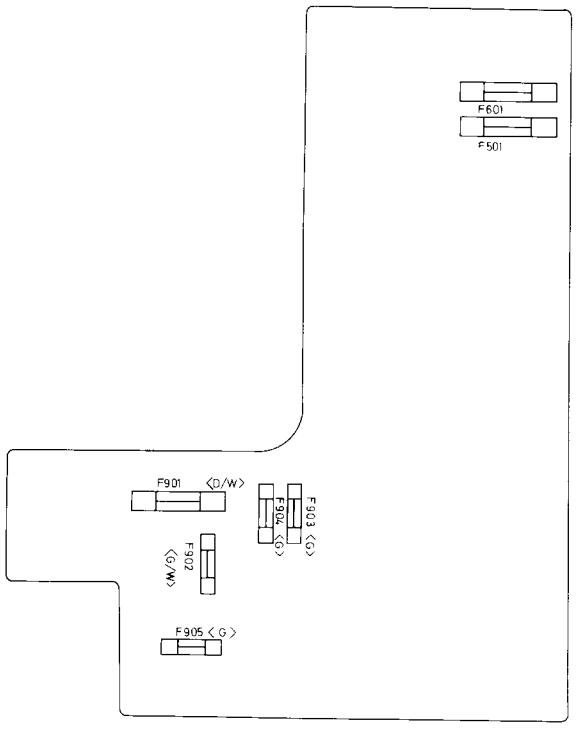
3. Safety-check out

(Only U.S.A. model)

After correcting the original service problem, perform the following safety check before releasing the set to the customer.

Connect the insulating-resistance tester between the plug of power suuply cord and terminal GND on the back panel.

Specifications: 3.3Mohm ±10% at 500V.



〈Fig. 1〉

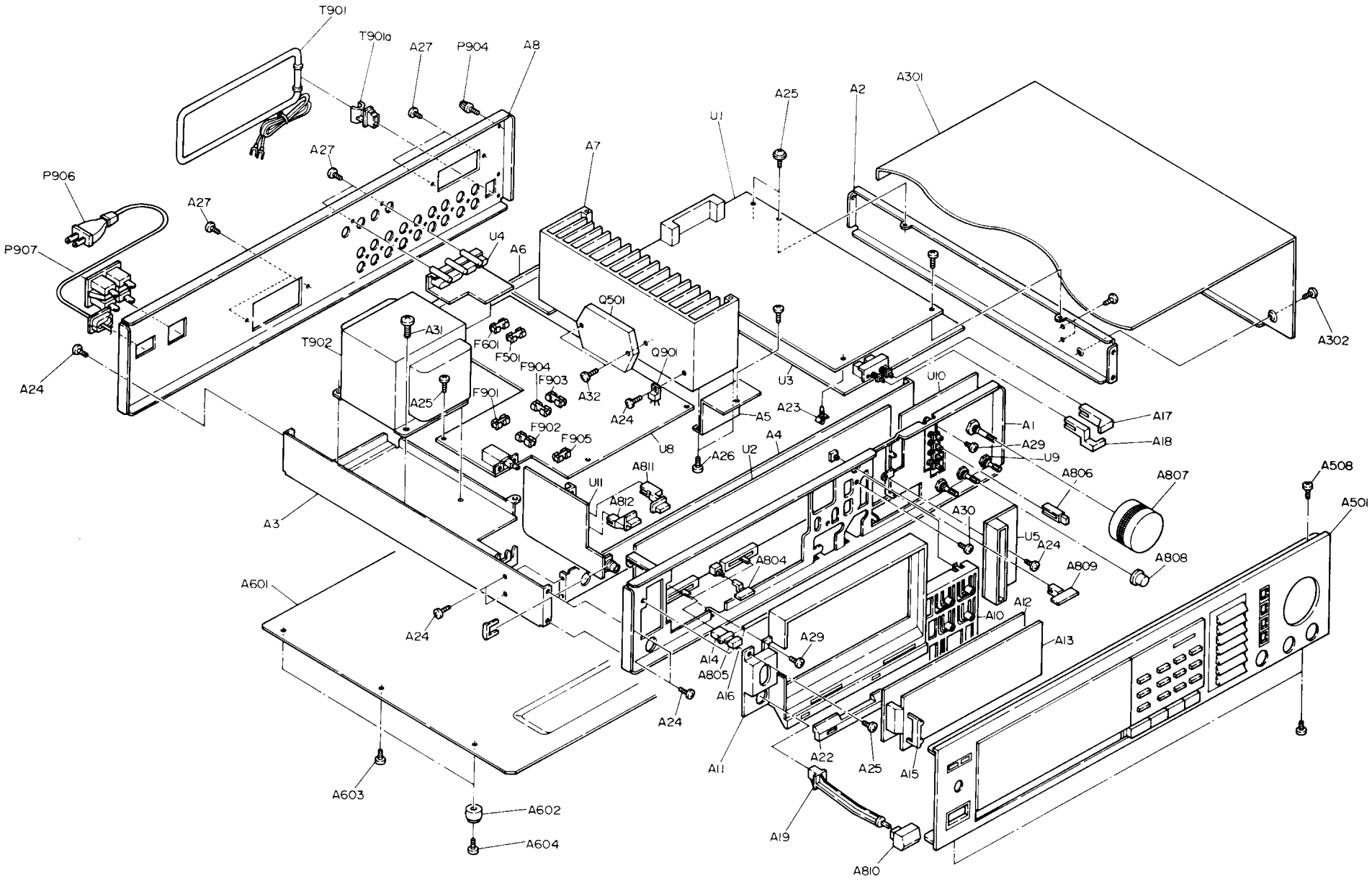
4. Removement of the digital pc board

①. Remove the five screws holding the top cover and chassis (side bracket:4, back panel:1), and remove the top cover.
②. Remove the five screws holding the front panel and front bracket, and remove the front panel.
③. Set the shift switch to 1-8 position, and remove the shift knob(A809).
④. Remove the four nails of holder, switch(A10) from the front bracket, and remove the holder, switch.
⑤. Remove the holder, dial plate(A15).
⑥. Set the volumes of Dynamic bass and Stereo image expander to the minimum position.
⑦. Remove the stopper of headphone terminal.
⑧. Remove the two screws holding the front bracket and holder, and remove the holder.
⑨. Remove the two screws holding the front bracket and holder L.E.D. on the digital pc board.
⑩. Remove the digital pc board from the three bent sections of domw side of front bracket.
(Refer the exploded view of next page.)

5. Memroy preservation

This unit does not require memory preservation batteries. A built-in memory power back-up system preserves contents of the memory during power failures and even when the unit is unplugged. The unit must be plugged in and the power swith turned on and off once in order to charge the back-up system. Note that since this is not a permanent memory, the power switch must be turned on and off a few times each month to keep the back-up system operable. The period of time during which memory contents are preserved after power has last been turned off varies depending on climate and the location and placement of the unit. On the average, memory contents are protected over a period of 3 to 4 weeks (a minimum of 2 weeks) after the last time power has been turned off. This period is shorter when the unit is exposed to very high humidity or used in an area with an extremely humid climate.

EXPLODED VIEW



PARTS LIST

REF.NO.	PART NO.	DESCRIPTION
A1	27110274A	Front bracket
A2	27115180A	Side bracket R
A3	27130388B	Bracket, power transformer
A4	27130422	Bracket, center
A5	27141057	Bracket C
A6	27141058	Bracket, radiator
A7	27160184	Radiator
A8	27120819	Back panel <D>
	27120820A	Back panel <G>
	27120840	Back panel <Q>
A10	27190436A	Holder, switch
A11	27190440A	Holder
A12	28133159	Back plate
A13	28130234	Dial plate
A14	27220032A	Slider
A15	27190359A	Holder, dial plate
A16	27260171B	Shaft
A17	27273048	Joint T-1
A18	27273049	Joint T-2
A19	27273030C	Joint
A20	28140104	12×30×8mm, Cushion
A21	27300750	⚠ Strainrelief
A22	27267401A	Guide
A23	27190011	Holder
A24	834430068	3TTS+6B(BC), Tapping screw
A25	831130088	3TTW+8B, Tapping screw
A26	838440089	4TTB+8C(BC), Tapping screw
A27	834430108	3TTS+10B(BC), Tapping screw
A28	834230108	3TTS+10B(Ni), Nickel screw
A29	82143006	3P+6FN(BC), Pan head screw
A30	833430080	3TTP+8P(BC), Tapping screw
A31	830440089	4TTC+8C(BC), Tapping screw
A32	834430168	3TTS+16B(BC), Tapping screw
A33	27150218	Shielded plate
A301	28184272B	Top cover
A302	834430068	3TTS+6B(BC), Tapping screw
A501	18618121	Front panel ass'y
A508	838430068	3TTB+6B(BC), Tapping screw

REF.NO.	PART NO.	DESCRIPTION
A601	27170198-1	Bottom board
A602	27175009A	Leg
A603	834430068	3TTS+6B(BC), Tapping screw
A604	834430128	3TTS+12B(BC), Tapping screw
A801	28322471A	Knob ass'y, selector
A802	28322479	Knob ass'y
A804	28322466A	Knob, expander
A805	28322006	Knob, slide
A806	28322481A	Knob, loudness
A807	28322482	Knob, volume
A808	28322021-1	Knob, balance
A809	28322022A	Knob, shift
A810	28321905B	Knob, power
A811	28322304	Knob, speaker A
A812	28323305	Knob, speaker B
F501,601	252059	⚠ 4A(SS-2), Speaker protection fuse <D>
F501,601	252077	⚠ 4A-SE-EAK, Speaker protection fuse <G/Q>
F901	252049	⚠ 4A(ST-6), Primary fuse <D>
F902	252074	⚠ 2A-SE-EAK, Primary fuse <G/Q>
F903,904	252078	⚠ 5A-SE-EAK, Secondary fuse <G/Q>
F905	252070	⚠ 1A-SE-EAK, Secondary fuse <G/Q>
P904	25060044	Terminal, ground
P906	253123	⚠ AS-UC-6#18, Power supply cord <D>
P906	253128 or 253130	⚠ AS-CEE, Power supply cord <G/Q>
P907	25050278	⚠ NSCT-4P106T, AC outlet <D>
Q501,601	222046	STK4913, Power amplifier IC
Q901	222780122	78M12, Constant voltage IC
T901	232085	NMA-3034, AM loop antenna(Accessory)
T901a	27190105	Holder, antenna
T902	2300079	⚠ NPT-913D, Power transformer <D>
	2300080	⚠ NPT-913G, Power transformer <G>
	2300109	⚠ NPT-913Q, Power transformer <Q>

REF.NO.	PART NO.	DESCRIPTION
U1	18608580-1	NARF-2580-1, Tuner circuit pc board ass'y <D>
	18604580-1A	NARF-2580-1A, Tuner circuit pc board ass'y <G/Q>
U2	18608581-1	NADG-2581-1, Digital circuit pc board ass'y <D>
	18604581-1A	NADG-2581-1A, Digital circuit pc board ass'y <G/Q>
U3	18608582-1	NAEQ-2582-1, Equalizer ampliifier pc board ass'y <D>
	18604582-1A	NAEQ-2582-1A, Equalizer ampliifier pc board ass'y <G/Q>
U4	18608583-1	NAVD-2583-1, Video circuit pc board ass'y
U5	18608584-1	NASW-2584-1, Selector Switch pc board ass'y
U8	18608587-1	NAMA-2587-1, Power amplifier and power supply pc board ass'y <G/Q>
	18604587-1A	NAMA-2587-1A, Power amplifier and power supply pc board ass'y <G/Q>
U9	18608588-1	NATC-2588-1, Tone control pc board ass'y
U10	18608589-1	NAVR-2589-1, Volume pc board ass'y
U11	18608590-1	NAHP-2590-1, Headphone terminal pc board ass'y <G/Q>
	18618590-1A	NAHP-2590-1A, Headphone terminal pc board ass'y <D>

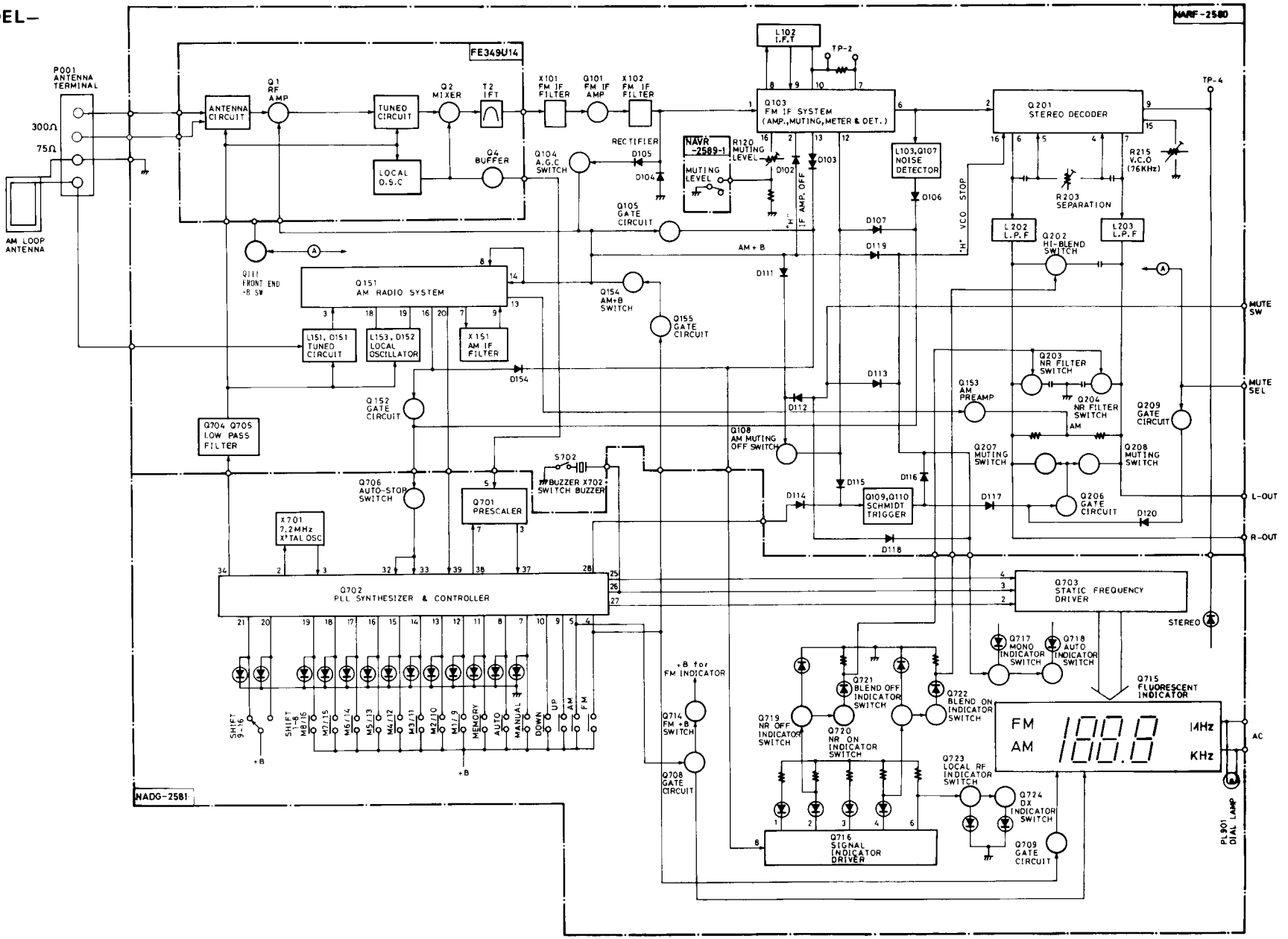
Note: <D>:Only 120V model
<G>:Only 220V model
<Q>:Only 240V model

NOTE: THE COMPONENTS IDENTIFIED BY MARK ⚠ ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE ONLY WITH PART NUMBERS SPECIFIED.

BLOCK DIAGRAM

–TUNER SECTION–

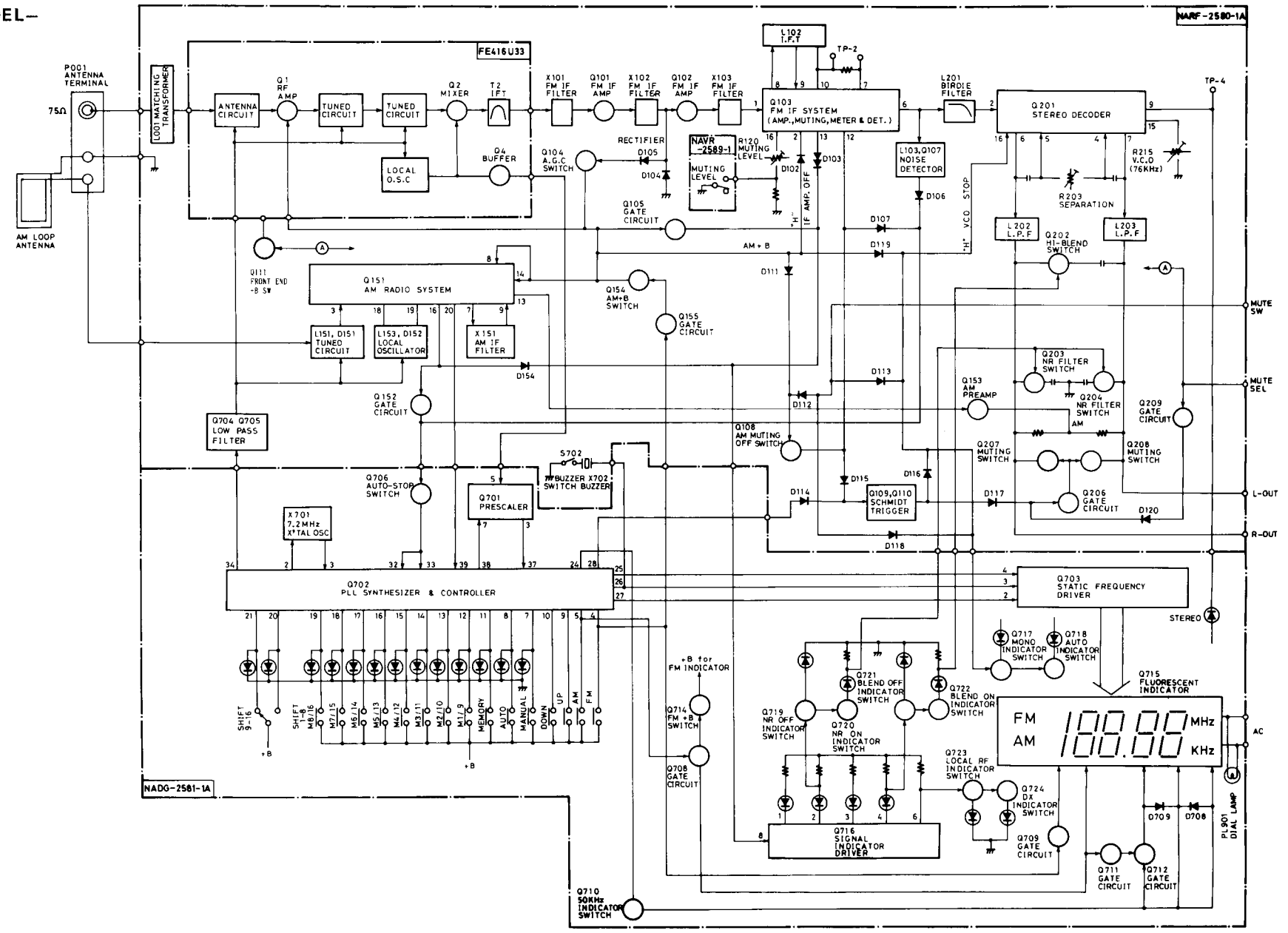
–120V MODEL–



BLOCK DIAGRAM

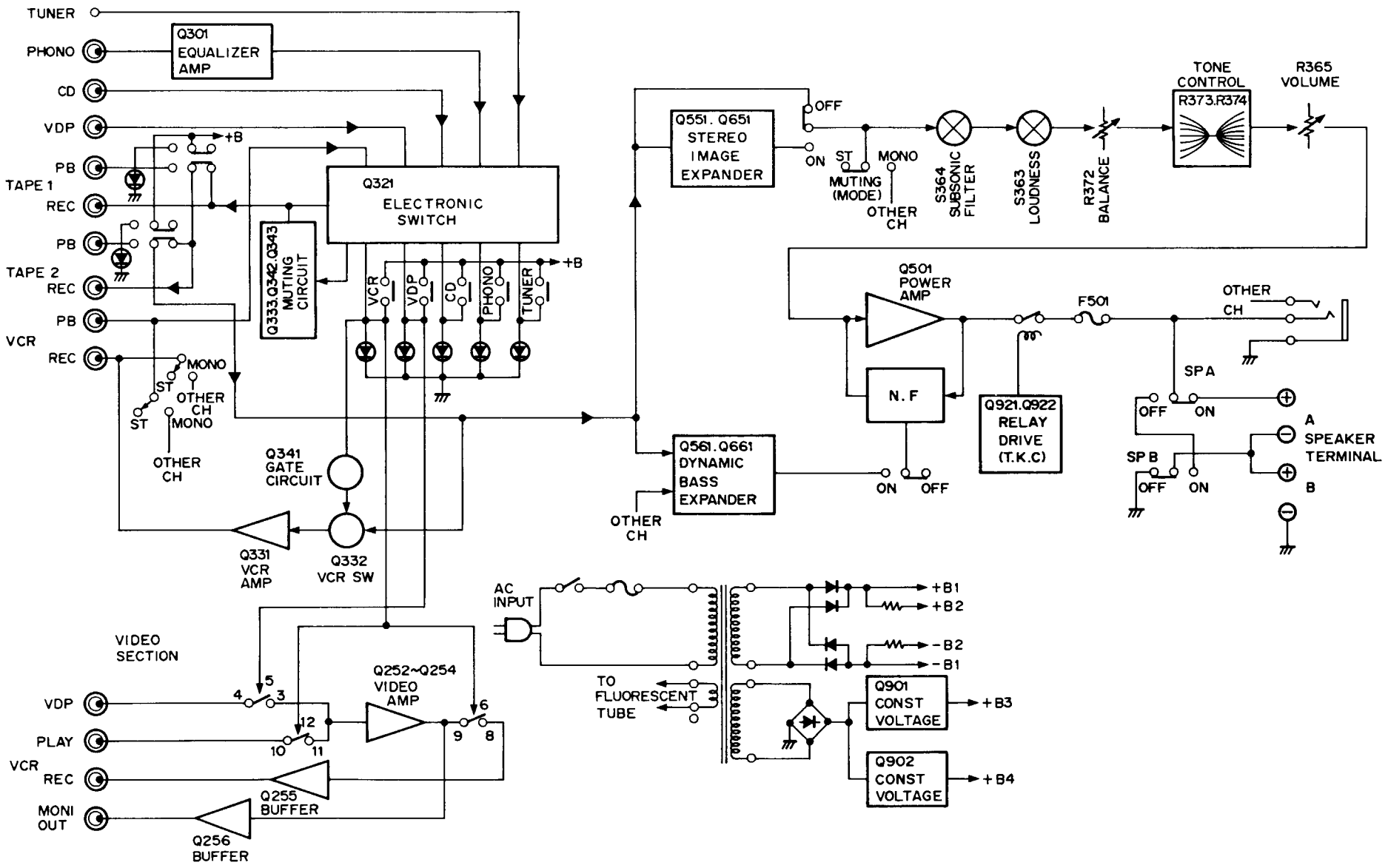
–TUNER SECTION–

–220V MODEL–



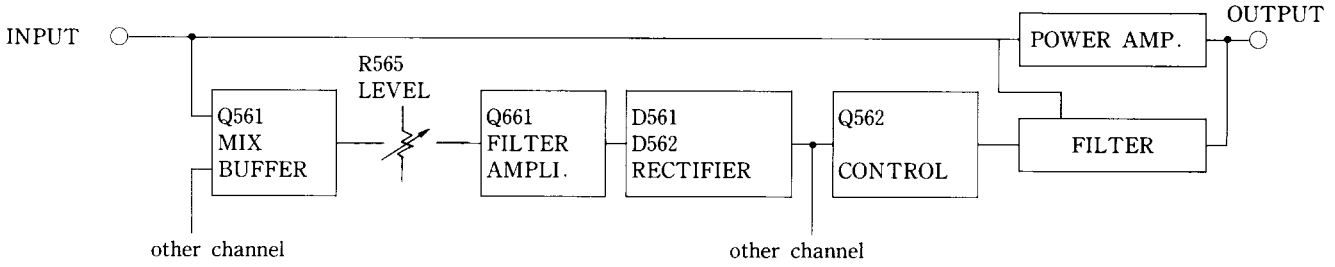
BLOCK DIAGRAM

–AMPLIFIER SECTION–



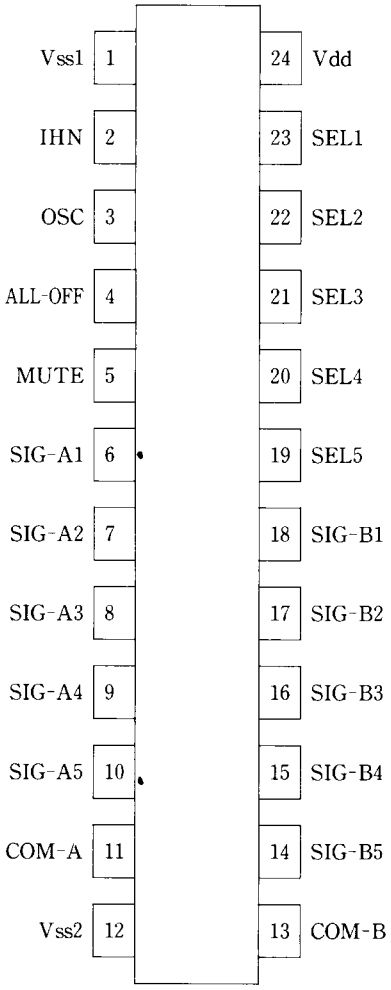
CIRCUIT DESCRIPTIONS

1. Dynamic bass expander



In earlier super bass systems, only the frequencies about 70Hz were boosted by about 4dB to expand the playback frequency response to enable playback of the super low region. However,when there was no input signal, the above frequency response resulted in deterioration in the S/N ratio in the 70Hz region. This problem has been overcome by the dynamic bass expander where the 70Hz boosted level is varied according to the input signal level.That is,the frequency response remains flat when no input signal is applied,but is boosted at the 70Hz region to the specified level when the input signal exceeds a certain level.The left and right channel input signals from the INPUT terminals are mixed by Q561 and pass through the level volume and filter amplifier.The signal is rectified by D561 and D562,and the resultant DC componemt control signal is applied to the gate of Q562.When the input signal is at a adequate level,Q562 is turned on and the super base circuit of power amplifier is controlled by the input signal.

2. Operation of analog switch



1.Vssl · · · Connect to the ground.
2.INH · · · Inhibit input terminal.Operates normally at the high level. Inhibit status at the low level.
3.OSC · · · CR connection terminal for the oscillator that determines the muting time and selector timing of analog switch.
4.ALL-OFF · Off designation input terminal of analog switches.All analog switches turn off at the high level.
5.MUTE · · Muting signal output terminal. If an "H" level input is received at this selection input terminal (SEL-1 ~SEL-5), this terminal becomes "H" level for a fixed period only. Within that period the analog switch changes.
6.SIG-A1 · · Signal input terminal.
18.SIG-B1 If SEL-1 is selected, analog switch 1 goes ON, and conductivity exists between this terminal and the COM terminal.
7-10.SIG-A2 ~SIG-A5·····Same as above.
17-14.SIG-B2~SIG-B5
11.COM-A · Analog switch common terminal.
13.COM-B
23.SEL-1 · · Selector input terminals for the various analog switches.
22.SEL-2 If an "H" level is set for the SEL-1 ~SEL-5 terminals,each analog
21.SEL-3 switch that is selected goes ON. SEL-1,SEL-2,SEL-3,SEL-4,and
20.SEL-4 SEL-5 are of the matually reset type. If there is other than
19.SEL-5 select input, they go OFF.
24.Vdd · · · Terminal of the power supply voltage.

3. Synthesizer and controller operation

Pin No.	Symbol	Terminal	Description
1	GND	Ground	
2	XT	X'tal	Connected to the 7.2MHz crystal oscillator for the reference frequency.
3	XT		
4	FM	FM band specification input	Mutual reset type, performs switching of each band, FM/MW/LW.
5	MW	MW band specification input	
6	LW	LW band specification input	
7	MANUAL	Manual tuning mode specification input	Mutual reset type, performs auto search and manual operation mode switching during UP/DOWN tuning.
8	AUTO	Auto search tuning mode specification input	
9	UP	UP tuning key input	Connect the push key and perform UP/DOWN tuning.
10	DOWN	DOWN tuning key input	
11	STO	Memory store command input	The preset memory is set to the write mode when the key is pressed.
12~19	M1~M8	Preset memory channel specification input	Controls the write and read out of the internal 16-station preset memory along with the MC1 and MC2 input.
20	MC-1	Memory control input	Set the 16-station preset memory to the 8 FM/8 AM station mode or the FM/AM 2-band 16-station random mode. The 16-station random mode is used in this unit.
21	MC-2		
22	OSC2	AM oscillator terminal	CR connection terminal for the oscillator that determines the scan speed during the AM search mode.
23	OSC1	FM oscillator terminal	CR connection terminal for the oscillator that determines the scan speed during the FM search mode.
24	0/5	FM 50kHz output	Output that represents the 50kHz FM band tuning step for European models. Goes to the high level for the 50kHz setting.
25	CK2	Tuned frequency data output	Outputs the serial data and timing clock to the tuned frequency display driver.
26	CK1		
27	DATA		
28	MUTE	Muting signal output	Goes to the high level during muting output.
29	E2	Region specification input	See table 1.
30	E1		
31	STOP 3	AM IF signal input	During AM reception, this counts the IF signal and stops auto search.
32	STOP 2	Auto search stop signal input	When the stop 1 input (pin 33) is at the high level and this terminal goes to the high level, auto search is stopped.
33	STOP 1	Scan speed slow input	When the high level is input at this terminal, the auto search speed is cut in half.

Pin No.	Symbol	Terminal	Description
34	DO 1	Error output	Charge pump output of the phase detector which constitutes the PLL. High level is output when the divided oscillation frequency is high than the reference frequency. In the opposite case, low level is output. Floating occurs when the frequencies match. The output is applied to the variable capacitor diode in the front end through low pass filter Q704 and Q705. The output from both terminals is the same, but only DO1 is used.
35	DO 2		
36	TEST	Test terminal	Test mode at the high level.
37	FM IN	FM programmable counter input	Connect to the prescaler output (pin 3 of Q701)
38	PSC	Pulse swallow control output	Output to the control the division ratio of the prescaler.
39	AM IN	AM local oscillator signal input	Terminal for input of AM local oscillator signal.
40	$\overline{\text{INH}}$	Inhibit input	Operates normally at the high level. Inhibit status at the low level.
41	$\overline{\text{INT}}$	Initialize input	Operates normally at the high level. At the low level, the internal status is initialized.
42	Vdd	Power supply	Device power terminal: supplies 5V during the normal operation and 2.5V from the super capacitor (C712) for the memory preservation.

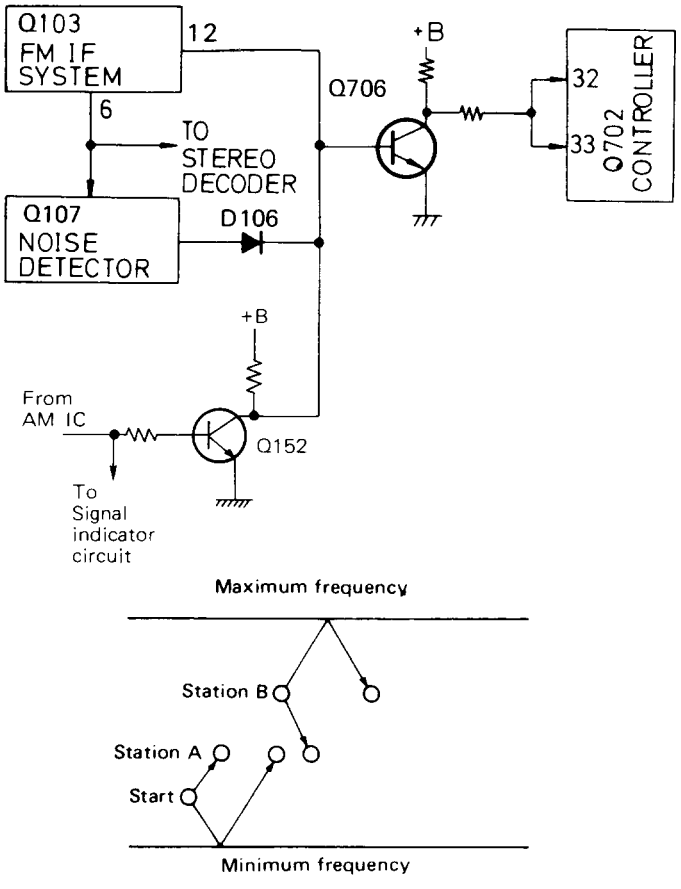
Table 1

E1 (Pin 30)	E2 (Pin 29)	Region	Band	Frequency range	Intermediate Frequency	Scan step	Reference Frequency
0	1	U.S.A	FM	87.5~108.0MHz	+10.7MHz	100kHz	25kHz
			AM 1	520 ~1710kHz	+450kHz	10kHz	10kHz
1	1		AM 2	522 ~1710kHz	+450kHz	9kHz	9kHz
1	0	Europe	FM	87.50 ~108.00MHz	+10.7MHz	50kHz	25kHz
			MW	522 ~1611kHz	-450kHz	9kHz	9kHz
			LW	153 ~360kHz	+450kHz	1kHz	1kHz
0	0	Japan	FM	76.0~90.0MHz	-10.7MHz	100kHz	25kHz
			AM	522 ~1611kHz	+450kHz	9kHz	9kHz

4. Auto Hi-blend and NR switching circuit

The Q103 FM IF system incorporates IC's with a built-in IF level detector with a 13 pin output.
If an input above 38dB enters the antenna, the 4 pin of Q716 signal driver becomes low level, the Q721 is turned on, the Q722 and Q202 are turned off and the high blend function is turned off.
If an input above 17dB enters the antenna, the 2 pin of Q716 signal driver becomes low level, the Q719 is terned on, the Q720, Q203 and Q204 are turned off and the NR function is turned off.

5. Auto search tuning circuit



〈Fig. 8〉

During FM reception, this is operated by the IF level detection and zero cross detection circuits included in the FM IF system IC of Q103 and by the noise component detection circuit of Q107. When a station is tuned, the output of all outputs go to the low level so Q706 goes from on to off, causing pins 32 and 33 of the controller IC to go to the high level to complete auto search tuning.
During AM reception, this is operated by the IF level detection included in the AM radio system IC of Q151. When a station is turned, Q152 goes from off to on and Q706 goes to off, causing pins 32 and 33 of the controller IC to go to the high level to complete auto search tuning.

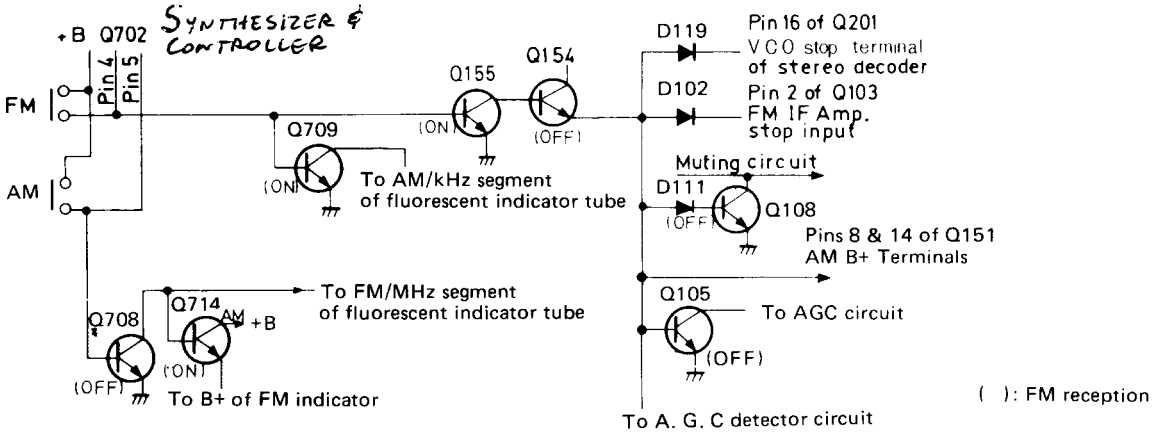
● Manual tuning

When the UP or DOWN key is pressed, the frequency goes up or down by one step. When either key is held down, the frequency repidly increases or decreases (scans) and stops when the key is released. When either end of the tuning range is reached, key input will no longer be received and the frequency will stop at the highest or lowest frequency.

● Auto Tuning

When the UP or DOWN key is pressed, scanning begins in the up or down direction, stopping where there is a radio station. Since auto scan is operated by a triangular wave, scanning in begun in the opposite direction the instant either end of the tuning range is roached.
Also, if the UP or DOWN key is pressed when the tuned frequency is not at either end of the range, up or down scanning will begin.

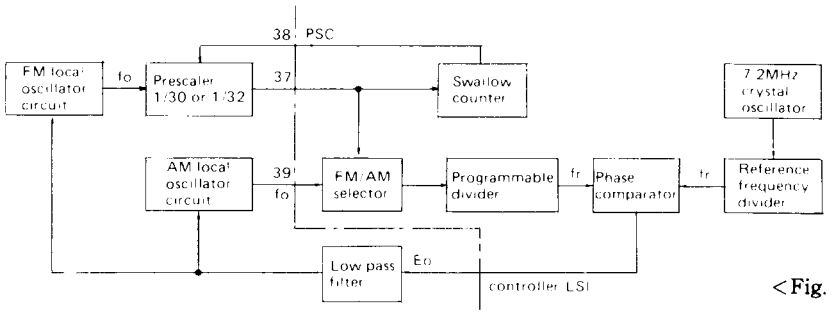
6. FM/AM switching circuit



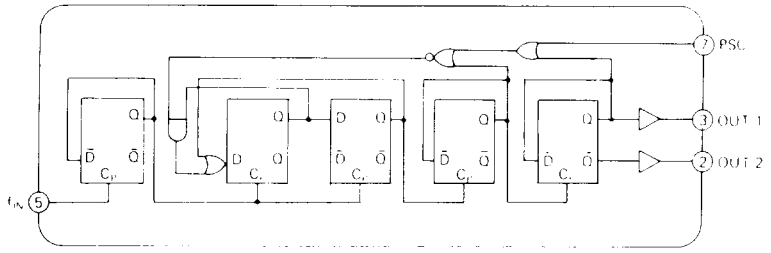
〈Fig. 9〉

The FM/AM selector circuit is shown in the diagram fig. 9. Pins 4 and 5 of Q702 are the mutual reset type. For FM, pin 4 is high and pin 5 is low; for AM, pin 4 is low and pin 5 is high. Because pin 5 is high and pin 4 is low during AM reception, Q709 is off, the AM, kHz segments of fluorescent display are turned on. Also, since Q708 goes to on and Q714 turned off, and the FM indicators are turned off.
At the same time, Q155 is turned off and Q154 turned on, so +B is supplied to the power source terminal of the radio system pins 8 & 14 of Q151.
Pin 16 of Q201 goes to the high level, the VCO oscillator stops, and pin 2 of Q103 goes to the high level so that the FM IF amp is also switched off. Also, during AM reception, Q108 is turned on so the muting circuit is off. During FM reception, all of the switching transistors mentioned above perform the opposite operations to switch to the FM mode. Figures in parenthese indicate transistor operation during FM reception.

7. PLL tuned circuit



<Fig. 10>



〈Fig.11〉 TD6104P block diagram

A block diagram of the tuned of the PLL is shown in fig. 10.

Operation during AM reception

The reception frequency is applied to the programmable divider where it is divided to 1/N and output as fv. This is applied to the phase comparator where it is comparated with frequency reference fr(9kHz for G/W models and 10kHz for D model). If fr and fv differ, Eo equal to the difference in frequency is output. Since error output Eo is a pulse waveform, it is passed through the low pass filter to change it into DC voltage Vd, which is applied to the variable capacitor diode in the front end to change the reception frequency. This continues until fv and fr are the same and Eo=0.

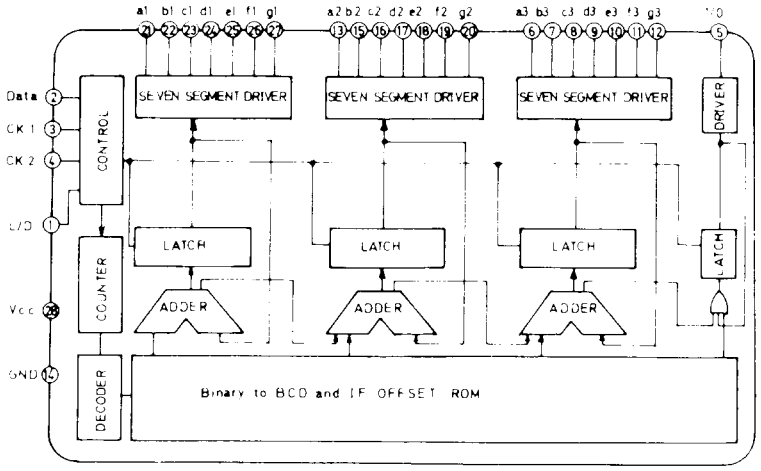
Operation during FM reception

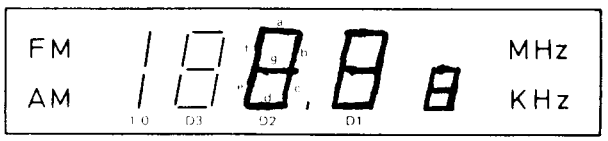
The pulse swallow method is used in the prescaler of this unit. In this type of prescaler, a supplementary number (changed accordimg to the program code input) and the divided reception frequency from the prescaler are combined in the control counter and the prescaler's division factor is switched 1/30 or 1/32 according to external control(1/32 when the PSC terminal is "H" and 1/30 when it is "L").

The station oscillator frequency is applied to the programmble divider, but the programmable divider has an upper frequency limit of only 30MHz, so the pulse swallow-type prescaler, which can be used up to 150MHz, is inserted for division to 1/Np;

The signal is applied to the programmable divider and divided to 1/N. The result is compared with a 25kHz frequency reference in the phase detector and error is output as Eo until a match is obtained as in AM operation.

8. Frequency indicator circuit

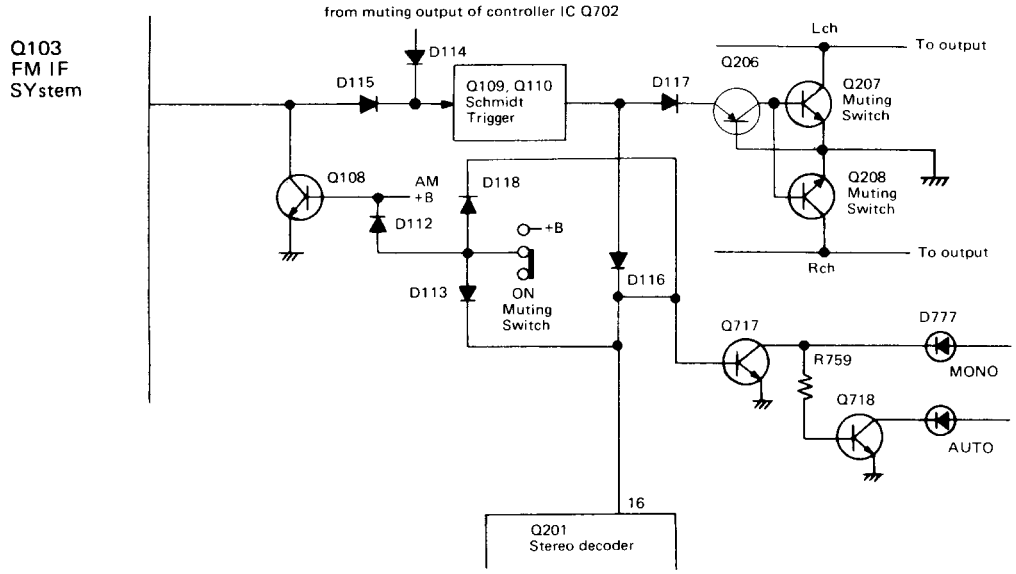




〈Fig.12〉 TD6301AP block diagram

Pin No.	Terminal	Description
1	L/D	Output indication switching input terminal:Fluorescent display at the low level,and LED display at the high level.
2	Data	Tuned frequency data input terminal:Input from the system controller LSI to the serial.
3,4	CK1 CK2	Tuned frequency data input control timing input terminal: Transferred simultaneously with data from the system controller LSI.
5	I/O	Segment drive output terminal:Sets the number of display digit for FM(100MHz) and AM(1000kHz) reception.
6-12	a3-g3	Seven segment drive output terminal:Sets the number of display digit for FM(10MHz) and AM(100kHz) reception.
13, 15-20	a2-g2	Seven segment drive output terminal:Sets the number of display digit for FM(1MHz) and AM(10kHz) reception.
21-27	a1-g1	Seven segment drive output terminal:Sets the number of display digit for FM(100kHz) and AM(1kHz) reception.
14	Vcc	Power source terminal
28	Gnd	Ground

9. Muting circuit



〈Fig.13〉

The muting circuit operates in the following cases.

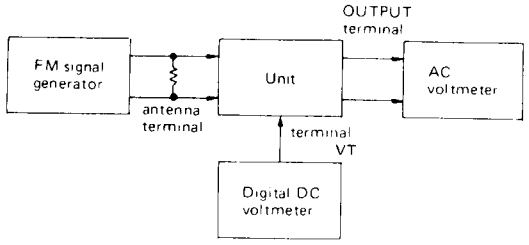
1. While pin 28 of controller IC outputs the high level, Q207 and Q208 are turned on and muting is closed in the following cases:(1)While the manual UP/DOWN switch is being held down,(2)When a station in the memory is recalled, and (3)While a radio station is being received using auto search tuning.
2. When an FM station is not being received (and the muting switch is on).
   The IF level in the FM IF system (set at R120 so muting is opened at 29.2dBf(High position)) and zero-cross detection circuit (tuning point 55kHz(100kHz step): 30kHz(50kHz step)-are output at pin 12 through the AND circuit.When a station is turned, the output goes to the low level.
   When output goes to the low level,Q109 turned off, Q110 is turned on and Q207 and Q208 are turned off, so muting is opened. At the same,pin 16 of stereo decoder Q201 goes to the low level, so the VCO oscillator starts.

ADJUSTMENT PROCEDURES

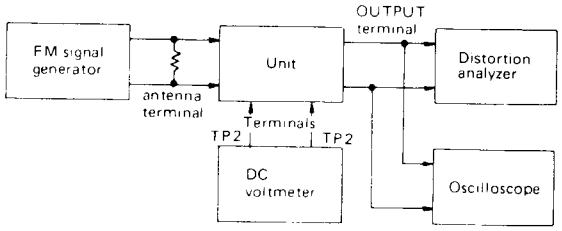
FM section

Item	Step	Connection of instrument	FM SG output	Stereo modulator output	Tuned frequency	Output indicator	Adjustment point	Adjust for	Remarks
Front end	1	Fig.1	———	———	88.0MHz	Digital DC voltmeter	L7	1.4V	Usually not necessary to adjust.
	2		107.9MHz 1kHz,75kHz devi.	———	107.9MHz	AC voltmeter	TC1,TC2(G) TC1(D)	Maximum output	
I F	1	Fig.2	99.0MHz 1kHz,75kHz devi. 65dBf(60dB)	———	99.0MHz	DC voltmeter	L102 Primary	0V	Set the muting switch to OFF. Repeat the steps 1 and 2 until no further adjustment is necessary.
	2					Distortion analyzer	L102 Secondary	Minimum	
V C O		Fig.3	99.0MHz 1kHz,75kHz devi. 65dBf(60dB)	———	99.0MHz	Frequency counter	R215	19kHz±10Hz	Set the muting switch to ON.
Stereo distortion		Fig.3	99.0MHz Ext. modulation 65dBf(60dB)	L+R 1kHz 67.5kHz devi.	99.0MHz	Distortion analyzer	T2	Minimum	
Stereo separation	1	Fig.3	99.0MHz Ext. modulation 65dBf(60dB)	Lch. 1kHz	99.0MHz	Rch. AC voltmeter	R203	Minimum	Maximum and same separation
	2			Rch. 1kHz		Lch. AC voltmeter		Minimum	
Muting level	1	Fig.2	99.0MHz 1kHz,75kHz devi. 29.2dBf(24dB)	———	99.0MHz	Oscilloscope	R120	Signal output	Set the muting level switch to HIGH and the muting switch to ON.
	2		99.0MHz 1kHz,75kHz devi. 28.2dBf(23dB)					No output	

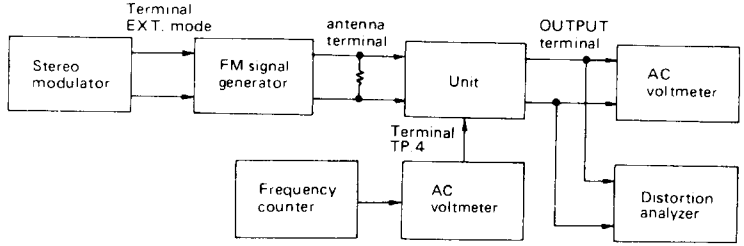
Note: (G):220V model (D):120V model



<Fig.1>



<Fig.2>

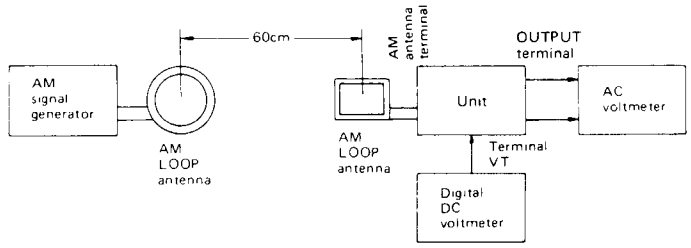


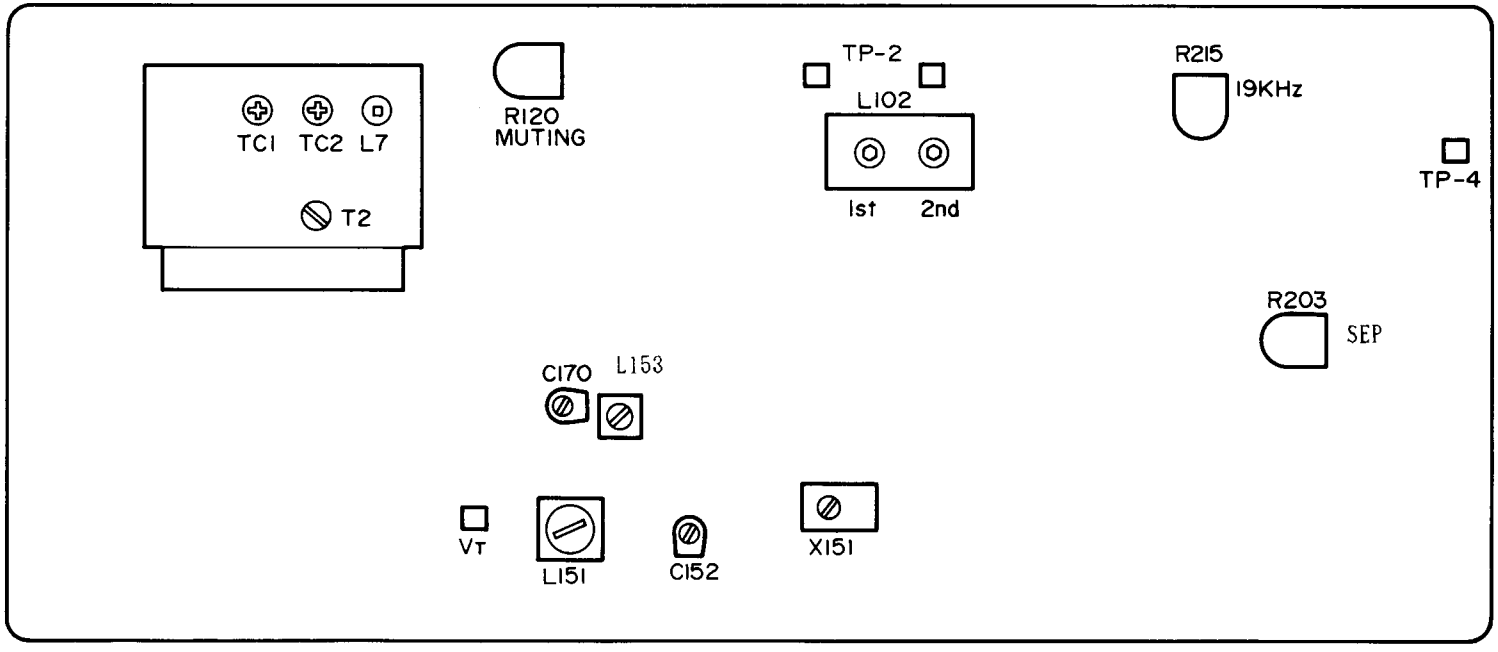
<Fig.3>

AM section

Step	AM SG output	Tuned Frequency	Output indicator	Adjustment point	Adjust for	Remarks
1	———	522kHz (520kHz)	Digital DC voltmeter	L153	1.2V±0.1V	Repeat the steps 1 and 2 until no further adjustment is necessary.
2	———	1611kHz (1710kHz)		C170	9.0V±0.1V (10.5V±0.1V)	
3	603kHz,60dB/m (600kHz) 400Hz 30% mod.	603kHz (600kHz)	A C voltmeter	L151	Maximum	Repeat the steps 3 and 4 until no further adjustment is necessary.
4	1404kHz,60dB/m (1400kHz) 400Hz 30% mod.	1404kHz (1400kHz)		C152	Maximum	
5	999kHz,30dB/m (1000kHz) 400Hz 30% mod.	999kHz (1000kHz)	A C voltmeter	X151	Maximum	

Note: ( ):120V model <10kHz step>





<Fig.14> Adjustment point

PRINTED CIRCUIT BOARD VIEW FROM BOTTOM SIDE

TUNER PC BOARD

PRINTED CIRCUIT BOARD-PARTS LIST

TUNER PC BOARD(NARF-2580-1/1A)

CIRCUIT NO.	PART NO.	DESCRIPTION
	Front end	
TU001	240061	FE349U14 〈D〉
TU001	240059	FE416U33 〈G〉
	ICs	
Q103	222540	HA11225
Q151	222701	LA1245
Q201	222678	μPC1161C3
	Transistors	
Q101	2211722 or	2SC1923(R) or
	2211723	2SC1923(O)
Q102	2211255 or	2SC1815(GR) or
	2211256	2SC1815(BL) 〈G〉
Q104,Q105	2211255,	2SC1815(GR),
Q107-Q110	2210746 or	2SC945A(P) or
Q152,Q154	2212485	JC501(Q)
Q155		
Q111,Q209	2211254,	2SC1815(Y),
	2211255,	2SC1815(GR),
	2210746 or	2SC945A(P) or
	2212485	JC501(Q)
Q153	2211256	2SC1815(BL)
Q202-Q204	2211945 or	2SK246(GR) or
	2212304	2SK381(D)
Q206	2211455 or	2SA1015(GR) or
	2212495	JA101(Q)
Q207,Q208	2212794,	2SD1468(R),
	2211705 or	2SD655(E) or
	2211706	2SD655(F)
Q704	2212294 or	2SK108(D) or
	2211293	2SK68(M)
Q705	2211255	2SC1815(GR)

CIRCUIT NO.	PART NO.	DESCRIPTION
	Diodes	
D101	2243192 or	MTZ-8.2B or
	2239552	RD8.2EB2 〈G〉
D102,D106	223155	1SS138
D103	4000068	VD1222
D104,D105	223132	1K60 〈D〉
D109-D120	223155	1SS138
D151,D152	223157	KV1236Z
D154	223155	1SS138
	Coils	
L001	233312	NFA3051 〈G〉
L101	233105 or	NCCH-1005 or
	233024	NCCH-1501
L103	233031	NMC-9-1
L151	232113	NMA-3049
L153	232110	NMO-4027
L201	233236	NMC-6027 〈G〉
L202,L203	233291	NMC-5039
	Transformer	
L102	233274	NFIF-6041
	Buzzer	
X702	241048	PKM24-4A0
	Ceramic filters	
X101,X102	3010071	SFE10.7MA5 〈D〉
X101	3010046	SFE-10.7MS2GY 〈G〉
X102,X103	3010043	SFE-10.7MM 〈G〉
X151	3010075	SFL-450B3
X152	3010076	BFU-450C

CIRCUIT NO.	PART NO.	DESCRIPTION
	Resistors	
R120	5215045	N08HR10KBC, Semi-fixed
R203	5215048	N08HR200KBC, Semi-fixed
R215	5215044	N08HR5KBC, Semi-fixed
	Switch	
	25065242	NSS-22104, Buzzer ⟨G⟩
	Socket	
	25050267	NSCT-3P95
	Terminal	
P001	25060085	NTM-4PDMN29, Antenna ⟨D⟩
P001	25060087	NTM-2PDMN31, Antenna ⟨G⟩
	Bracket	
	27141059	Ground

CIRCUIT NO.	PART NO.	DESCRIPTION
	Capacitors	
C101	352780339	3.3 μF, 50V, Elect.
C107, C110	352780109	1 μF, 50V, Elect.
C111	352741009	10μF, 16V, Elect.
C117	352784799	0.47μF, 50V, Elect.
C118	352742209	22μF, 16V, Elect.
C120	352741009	10μF, 16V, Elect.
C123	352784799	0.47μF, 50V, Elect.
C125	352780229	2.2 μF, 50V, Elect.
C126	352780109	1 μF, 50V, Elect.
C128, C129	352741009	10μF, 16V, Elect.
C152, C170	3060010	NTC-20P09, Trimmer
C158	352741009	10μF, 16V, Elect.
C161	352744709	47μF, 16V, Elect.
C162	352780109	1 μF, 50V, Elect.
C165, C166	352750479	4.7 μF, 25V, Elect.
C168	370135114	510pF ±5%, 100V, APS
C174	352781099	0.1 μF, 50V, Elect.
C175	352721019	100 μF, 6.3 V, Elect.
C176	352780339	3.3 μF, 50V, Elect.
C201	352744719	470 μF, 16V, Elect.
C203	352750479	4.7 μF, 25V, Elect.
C209, C210	352741009	10μF, 16V, Elect.
C212	352782299	0.22μF, 50V, Elect.
C213	352780109	1 μF, 50V, Elect.
C214	352780339	3.3 μF, 50V, Elect.
C215	370134714	470pF ±5%, 100V, APS
C220, C221	352780229	2.2 μF, 50V, Elect.
C705	395160107	1 μF, 35V, Tantalum

VIDEO CIRCUIT PC BOARD (NAVD-2583-1)

CIRCUIT NO.	PART NO.	DESCRIPTION
	IC	
Q251	22257502 or 222840661	TC4066BP or 4066B
	Transistors	
Q252	2211455 or 2212495	2SA1015(GR) or JA101(Q)
Q253-Q256	2211254, 2211255, 2210746 or 2212485	2SC1815(Y), 2SC1815(GR), 2SC945A(P) or JC501(Q)
	Capacitors	
C251, C253	352741009	10μF, 16V, Elect.
C252, C254	352734719	470 μF, 10V, Elect.
C255, C256	352741009	10μF, 16V, Elect.
	Terminal	
P251	25045192	NPJ-4PDBL76

Note: ⟨D⟩:Only 120V model
⟨G⟩:Only 220V/240V models

PRINTED CIRCUIT BOARD-PARTS LIST

DIGITAL CIRCUIT PC BOARD(NADG-2581-1/1A)

CIRCUIT NO.	PART NO.	DESCRIPTION
	ICs	
Q551,Q651	222502 or	NJM4558DX or
Q561,Q661	222811	NJM4558DD
Q701	222675	TD6104P
Q702	222674	TC9147BP
Q703	222673	TD6301AP
Q716	222670 or	BA6124 or
	222666	LB1403
	Fluorescent tube	
Q715	212016	FIP7B8CS
	Transistors	
Q562,Q662	2211945	2SK246(GR)
Q706,Q708	2211255,	2SC1815(GR),
Q709,Q717	2210746 or	2SC945A(P) or
Q718	2212485	JC501(Q)
Q710,Q711	2211254,	2SC1815(Y),
	2211255,	2SC1815(GR),
	2210746 or	2SC945A(P) or
	2212485	JC501(Q) 〈G〉
Q712	2211455 or	2SA1015(GR) or
	2212495	JA101(Q) 〈G〉
Q714	2212794	2SD1468(R)
Q719-Q724	2212600 or	DTA124ES or
	221243	2SA1346

CIRCUIT NO.	PART NO.	DESCRIPTION
	Diodes	
D561,D562	223155	1SS138
D701-D705	223155	1SS138
D706	2243152 or	MTZ5.6B or
	2239472	RD5.6EB2
D708,D709	223155	1SS138 〈G〉
D710	223155	1SS138
D711	2241291	RD3.3EB1
	L.E.Ds	
D751,D762	225142	SEL2913K
D763,D772	225142	SEL2913K
D774,D776	225142	SEL2913K
D777,D782	225142	SEL2913K
D788,D789	225142	SEL2913K
D752,D771	225137CG,	SEL2413ECG,
D754-D761	225137DG or	SEL2413EDG or
D766-D769	225137DY	SEL2413EDY
D773,D775	225137CG,	SEL2413ECG,
D778,D780	225137DG or	SEL2413EDG or
D781	225137DY	SEL2413EDY
D753,D779	225141	SEL2213C
	X'tal	
X701	3010073	XTL7.2M
	Capacitors	
C551	352780229	2.2 μF,50V,Elect.
C651	353780229	2.2 μF,50V,Elect.
C553,C653	352780229	2.2 μF,50V,Elect.
C554	353784799	0.47μF,50V,Elect.
C562	352732209	22μF,10V,Elect.

SELECTOR SWITCH PC BOARD

CIRCUIT NO.	PART NO.	DESCRIPTION
	Capacitors	
C565	352784799	0.47μF,50V.Elect.
C567,C667	353744709	47μF,16V,Elect.
C566,C666	352982296	0.22μF,50V,Non-polar elect.
C702	352744709	47μF,16V,Elect.
C709	352780109	1 μF,50V,Elect.
C710	352780229	2.2 μF,50V,Elect.
C711	352784799	0.47μF,50V,Elect.
C712	3020027 or 3020018	0.047F,5V,Super
C717	353744709	47μF,16V,Elect.
C718	352721019	100 μF,6.3V,Elect.
C720	352750479	4.7 μF,25V,Elect.
C722	352741009	10μF,16V,Elect.
C724	352742209	22μF,16V,Elect.
	Resistors	
R554	6142043	N30LL10KA15Z,Slide,Variable
R565	6142044	N30LL100KA15Z,Slide,variable
R729-R737	49121333409	33K ×9,1/8W,Network
R738-R750	49121333413	33K ×13,1/8W,Network
R775	442529104	91Ω,1/2W,Metal oxide film

CIRCUIT NO.	PART NO.	DESCRIPTION
	Switches	
S551,S552	25035515	NPS-142-L477,Push
S703-S717	25035389	NPS-111-S353,Push
S718	25035514	NPS-122-L476,Push
	Lamp	
PL901	210064A	PL6.3V,0.25A
	Holders	
	27190438A	LED
	27190437A	LED 10
	Cushion	
	28140593	10×40×3.5
	Screws	
	833426060	2.6TTP+6P(BC),Tapping

SELECTOR SWITCH PC BOARD (NASW-2584-1)

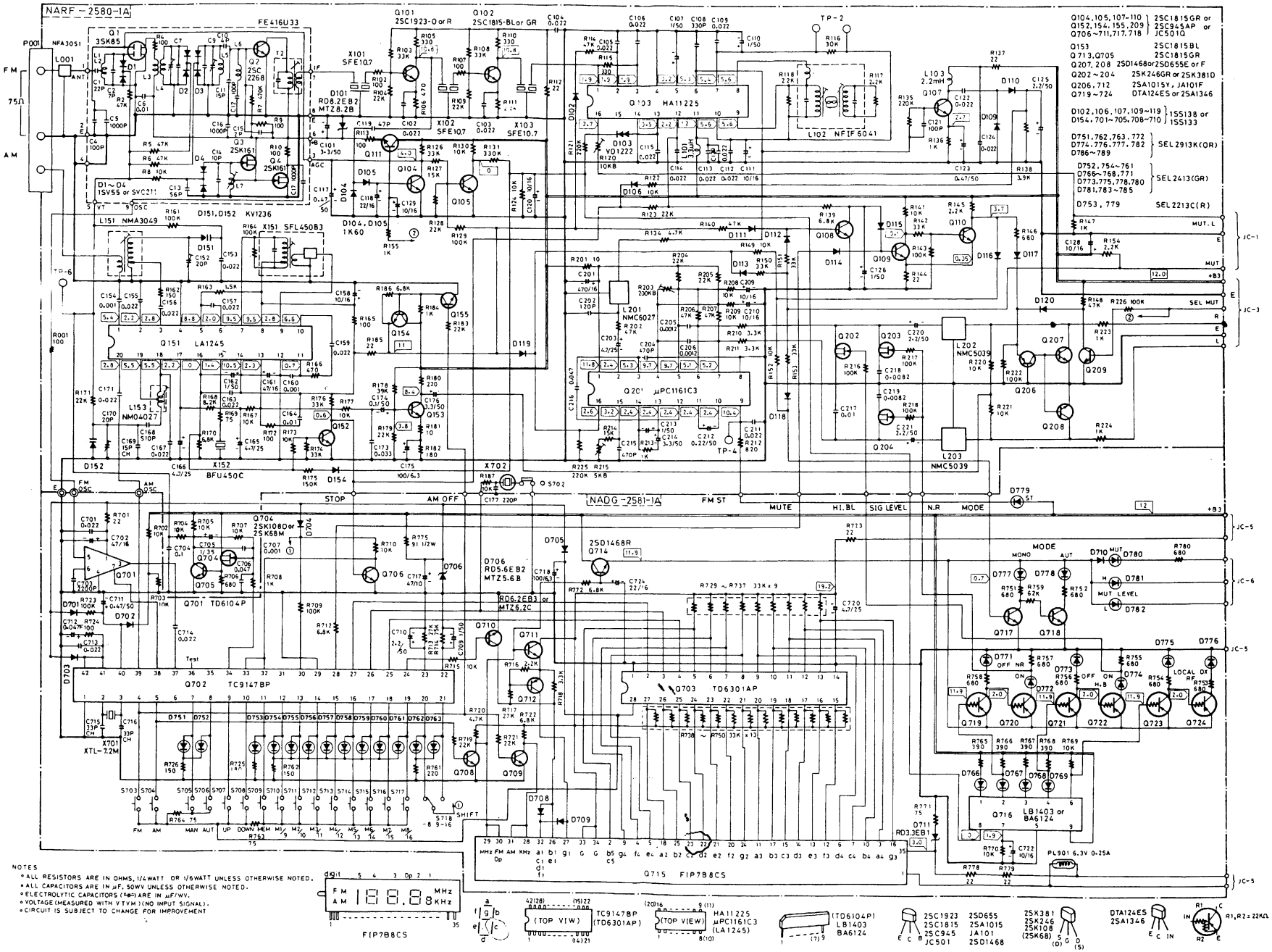
CIRCUIT NO.	PART NO.	DESCRIPTION
	L.E.Ds	
D381-D385	225137CG, 225137DG or 225137DY	SEL2413ECG, SEL2413EDG or SEL2413EDY
D386,D387	225142	SEL2913K
	Switches	
S381-S385	25035291 or 25035389	NPS-111-S257 or NPS-111-S353, Push
	Holder	
	27190439	

Note:<D>:Only 120V model
<G>:Only 220V/240V models

SCHEMATIC DIAGRAM

–TUNER SECTION–

–220V MODEL–



PRINTED CIRCUIT BOARD-PARTS LIST

TONE CONTROL PC BOARD(NATC-2588-1)

CIRCUIT NO.	PART NO.	DESCRIPTION
R371,R471	5146049	N16RLC250KWT30,Variable resistor,Balance
R372,R472	5148073	N16RQMC110K180K30,Variable resistor,Bass
R374,R474	5148102	N16RGMC219K30,Variable resistor, Treble

EQUALIZER AMPLIFIER PC BOARD(NAEQ-2582-1/1A)

CIRCUIT NO.	PART NO.	DESCRIPTION
	ICs	
Q301,Q401	222671 or	NJM4559DD or
	222534	NJM4559DX
Q321,Q421	222954	TC9152P
Q331,Q431	222811 or	NJM4558DD or
	222502	NJM4558DX
	Transistors	
Q332,Q432	2211945	2SK246(GR)
Q333,Q433	2212286 or	2SC2878(B) or
	2212285	2SC2878(A)
Q341,Q342	2211455 or	2SA1015(GR) or
	2212495	JA101(Q)
Q343	2211255,	2SC1815(GR),
	2210746 or	2SC945A(P) or
	2212485	JC501(Q)
	Diodes	
D321,D322	223155	1SS138
D331,D340	223155	1SS138
D431	223155	1SS138
	Capacitors	
C302,C402	352780229	2.2 μF,50V,Elect.
C305,C405	352721019	100 μF,6.3V,Elect.
C308,C408	352780229	2.2 μF,50V,Elect.
C309,C310	352743319	330 μF,16V,Elect.
C322,C323	352780339	3.3 μF,50V,Elect.
C325	352780159	1.5 μF, 50V,Elect.
C331,C332	352780229	2.2 μF,50V,Elect.
C333,C433	352781099	0.1 μF,50V,Elect.
C334,C335	357280339	3.3 μF,50V,Elect.
C341	352780339	3.3 μF,50V,Elect.
C342	352782299	0.22μF,50V,Elect.
C431,C432	352780229	2.2 μF,50V,Elect.
	Terminals	
P301,P302	25045171	NPJ-4PDBL65 <D>
P301,P302	25045165	NPJ-4PDBL59 <G>
P303	25045191	NPJ-6PDBL75 <D>
P303	25045166	NPJ-6PDBL60 <G>
P304	25045171	NPJ-4PDBL65 <D>
P304	25045165	NPJ-4PDBL59 <G>
	Switches	
S321,S322	25035518	NPS-242-L480
S323	25065242	NSS-22104
	Socket	
	25050267	NSCT-3P95

NOTE:<D>:Only 120V model
<G>:Only 220V/240V models

VOLUME CONTROL PC BOARD

VOLUME CONTROL PC BOARD(NAVR-2589-1)

CIRCUIT NO.	PART NO.	DESCRIPTION
C361,C461	352781599	0.15μF,50V,Elect. capacitors
R365,R465	5104180	N16RGH100KBT30,Variable resistor Volume
S361-S364	25035516	NPS-422-L478,Push switches
	25050280	NSCT-3P108,Sockets

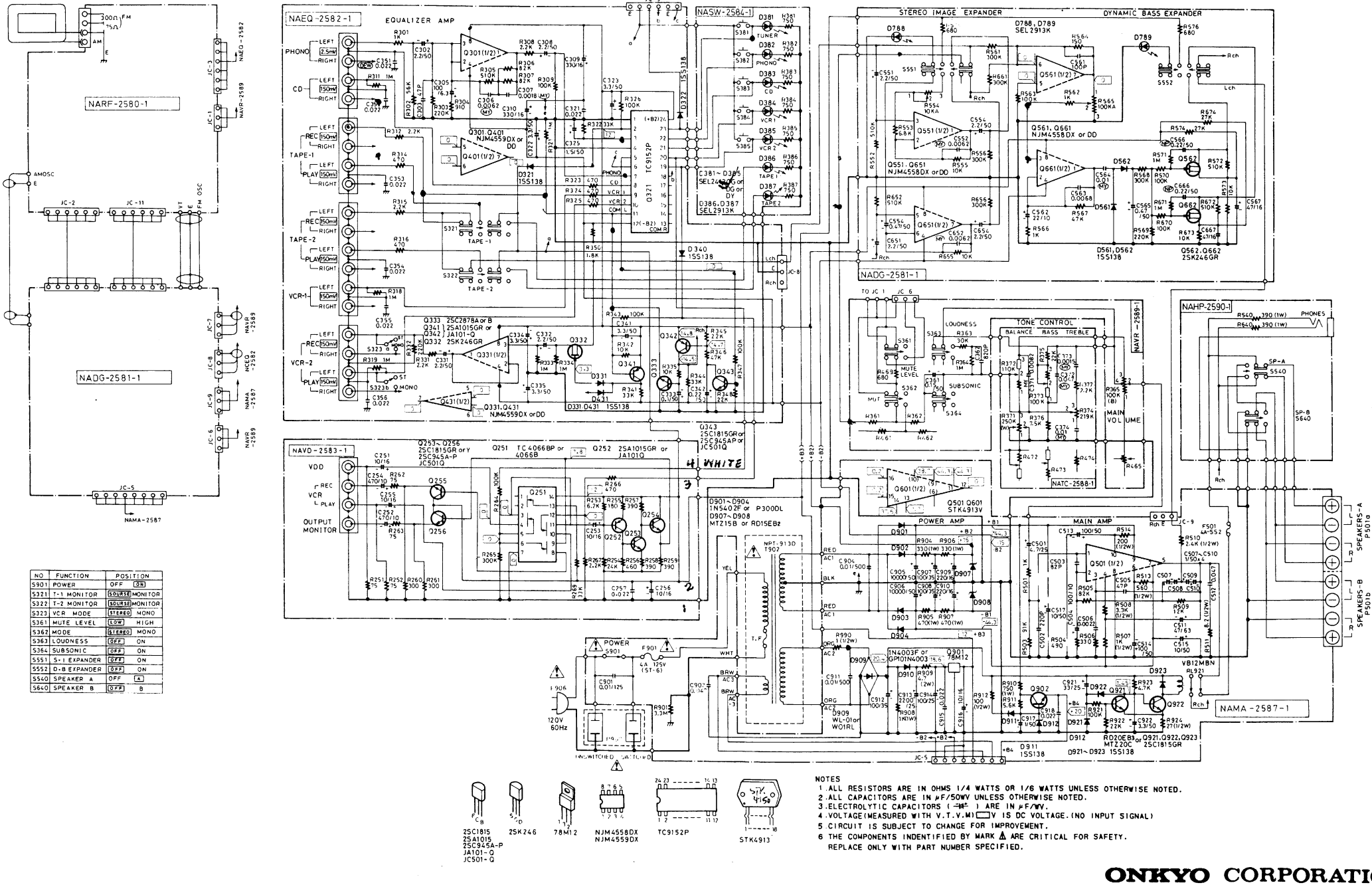
HEADPHONE TERMINAL PC BOARD (NAHP-2590-1/1A)

CIRCUIT NO.	PART NO.	DESCRIPTION
R540,R640	441523914	390 Ω,1/2W,Metal oxide film resistors
S540,S640	25035517	NPS-222-L479,Push switches
P540	25045184	HLJ0520-01-010,Headphone terminal <G>
	25045193	HLJ0521-01-010,Headphone terminal <D>

HEADPHONE TERMINAL PC BOARD

SCHEMATIC DIAGRAM

–120V MODEL–



NO	FUNCTION	POSITION
S901	POWER	OFF ON
S321	T-1 MONITOR	SOURSE MONITOR
S322	T-2 MONITOR	SOURSE MONITOR
S323	VCR MODE	STEREO MONO
S361	MUTE LEVEL	LOW HIGH
S362	MODE	STEREO MONO
S363	LOUDNESS	OFF ON
S364	SUBSONIC	OFF ON
S551	S-I EXPANDER	OFF ON
S552	D-B EXPANDER	OFF ON
S540	SPEAKER A	OFF A
S640	SPEAKER B	OFF B

NOTES

1. ALL RESISTORS ARE IN OHMS 1/4 WATTS OR 1/6 WATTS UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS ARE IN μF/50WV UNLESS OTHERWISE NOTED.
3. ELECTROLYTIC CAPACITORS (⊣⊢) ARE IN μF/WV.
4. VOLTAGE(MEASURED WITH V.T.V.M) □V IS DC VOLTAGE.(NO INPUT SIGNAL)
5. CIRCUIT IS SUBJECT TO CHANGE FOR IMPROVEMENT.
6. THE COMPONENTS INDENTIFIED BY MARK ⚠ ARE CRITICAL FOR SAFETY. REPLACE ONLY WITH PART NUMBER SPECIFIED.

PRINTED CIRCUIT BOARD–PARTS LIST

POWER AMPLIFIER AND POWER SUPPLY CIRCUIT PC BOARD (NAMA-2587-1/1A)

CIRCUIT NO.	PART NO.	DESCRIPTION
	ICs	
Q501,Q601	222046	STK-4913
Q901	222780122	78M12
	Transistors	
Q902	2211255	2SC1815(GR)
Q921,Q922	2211255	2SC1815(GR)
	Diodes	
D901-D904	22380003 or 223897	1N5402F or P-300DL
D907,D908	2243252 or 2239672	MTZ15B or RD15EB2
D909	223890 or 223862	W01RL or WL01
D910	223896 or 223880	1N4003F or GP101N4003
D911	223155	1SS138
D912	2239733 or 2243283	RD20EB3 or MTZ20C
D921-D923	223155	1SS138
	Coils	
L501,L601	231001	S-1.3B <G>

CIRCUIT NO.	PART NO.	DESCRIPTION
	Capacitors	
C501,C601	352750479	4.7 μF,25V,Elect.
C504,C604	3500080	100 μF,10V,Elect.<D>
	352731019	100 μF,10V,Elect.<G>
C507-C510	352780109	1 μF,50V,Elect.
C607-C610	352780159	1 μF,50V,Elect.
C511,C611	3500081	47μF,63V,Elect.<D>
C511,C611	352784709	47μF,50V,Elect.<G>
C513,C514	352781019	100 μF,50V,Elect.
C515,C615	352781009	10μF,50V,Elect.
C517	352781009	10μF,50V,Elect.
C901	3500065A	⚠DE7150FZ103PAC400V/125V,IS
C905,C906	3504147	10,000μF,50V,Elect.
C907,C908	352761019	100 μF,35V,Elect.
C909,C910	352742219	220 μF,16V,Elect.
C912	352761019	100 μF,35V,Elect.
C913	352752229	2,200 μF,25V,Elect.
C914	352751019	100 μF,25V,Elect.
C916	352741009	10μF,16V,Elect.
C917	352780109	1 μF,50V,Elect.
C921	352753309	33μF,25V,Elect.
C922	352780339	3.3 μF,50V,Elect.
	Resistors	
R507,R607	441521024	1kΩ,1/2W,Metal oxide film
R508,R608	441523324	3.3kΩ,1/2W,Metal oxide film
R510,R610	441522424	2.4kΩ,1/2W,Metal oxide film
R511,R611	441520824	8.2 Ω,1/2W,Metal oxide film
R512,R612	441520474	4.7 Ω,1/2W,Metal oxide film <G>
R513	441525614	560 Ω,1/2W,Metal oxide film
R514	441522014	200 Ω,1/2W,Metal oxide film
R901	431523355	⚠3.3MΩ,1/2W,Solid <D>
R904,R906	441623314	330 Ω,1W,Metal oxide film
R905,R907	441624714	470 Ω,1W,Metal oxide film
R908	441621024	1kΩ,1W,Metal oxide film
R909	441720474	4.7 Ω,2W,Metal oxide film
R910	441627514	750 Ω,1W,Metal oxide film
R912	441521014	100 Ω,1/2W,Metal oxide film
R924	441522704	27Ω,1/2W,Metal oxide film
R990	441520104	1 Ω,1/2W,Metal oxide film <D>
	Terminal	
P501	25060093	NTM-8P-DML34,Speaker <D>
P501	25060094	NTM-8P-DML35,Speaker <G>
	Switch	
S901	25035398	△NPS-111-L362P,Power
	Relay	
RL921	25065134	NRL-2P5A-DC24-07
	Fuseholders	
	250113	⚠SN5051 <D>
	25050065	⚠YSH403T<G>
	Fuses	
F501,F601	252059	⚠4A(SS-2) <D>
F501,F601	252077	⚠4A-SE-EAK <G>
F901	252049	⚠4A(ST-6) <D>
F902	252074	⚠2A-SE-EAK <G>
F903,F904	252078	⚠5A-SE-EAK <G>
F905	252070	⚠1A-SE-EAK <G>
	Sockets	
	25050267	NSCT-3P-95
	25050272	NSCT-8P-100
	Label	
	29360626-1	Fuse <D>
	29360374	T4A/250V <G>
	Bracket	
	27141059	Ground <D>